

## A Compact Low Frequency RF Structure

*How is a compact LF cavity possible?*

**A simple coil and a pair of rings**

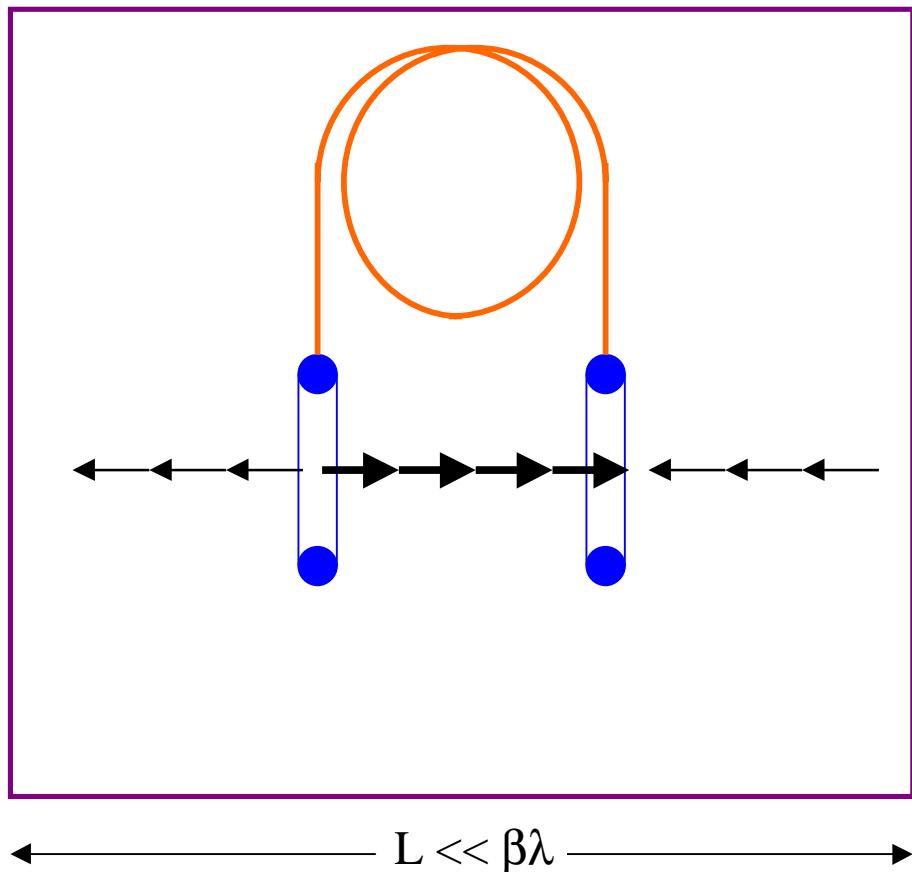
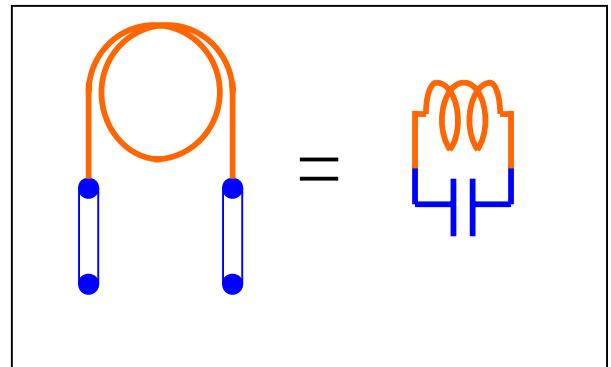
can form a LC resonator.

**But,**

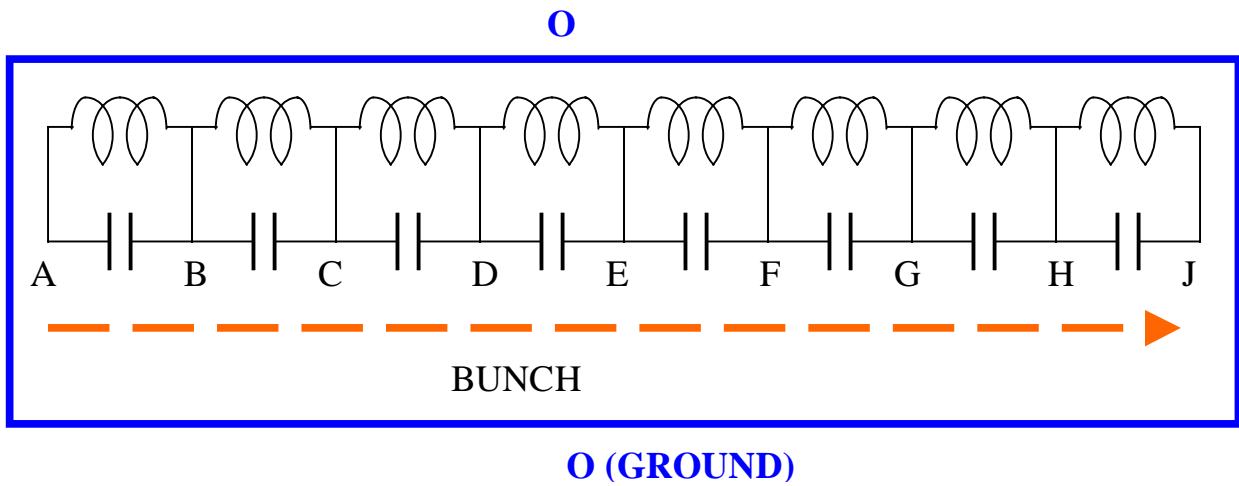
it's not good for an accelerator,

**Because**

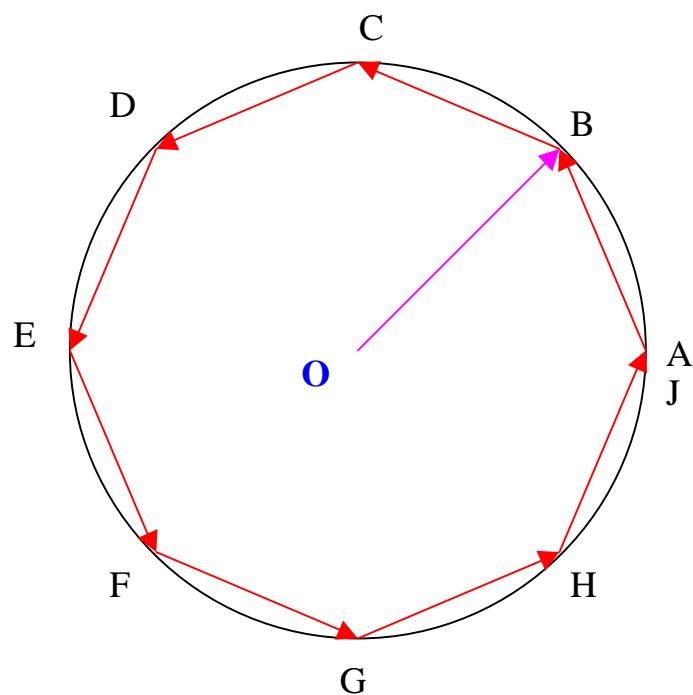
deceleration equals to (or close to) acceleration.



## LF TRAVELING WAVE ACCELERATOR (CONCEPTUAL DIAGRAM)



## VOLTAGE VECTOR DIAGRAM



# MAFIA

FRAME: 2 09/09/99 - 17:05:11

VERSION[v323.B]

TS902.DRC

TOROIDAL SOLENOID CAVITY  
FULL [RFZ]

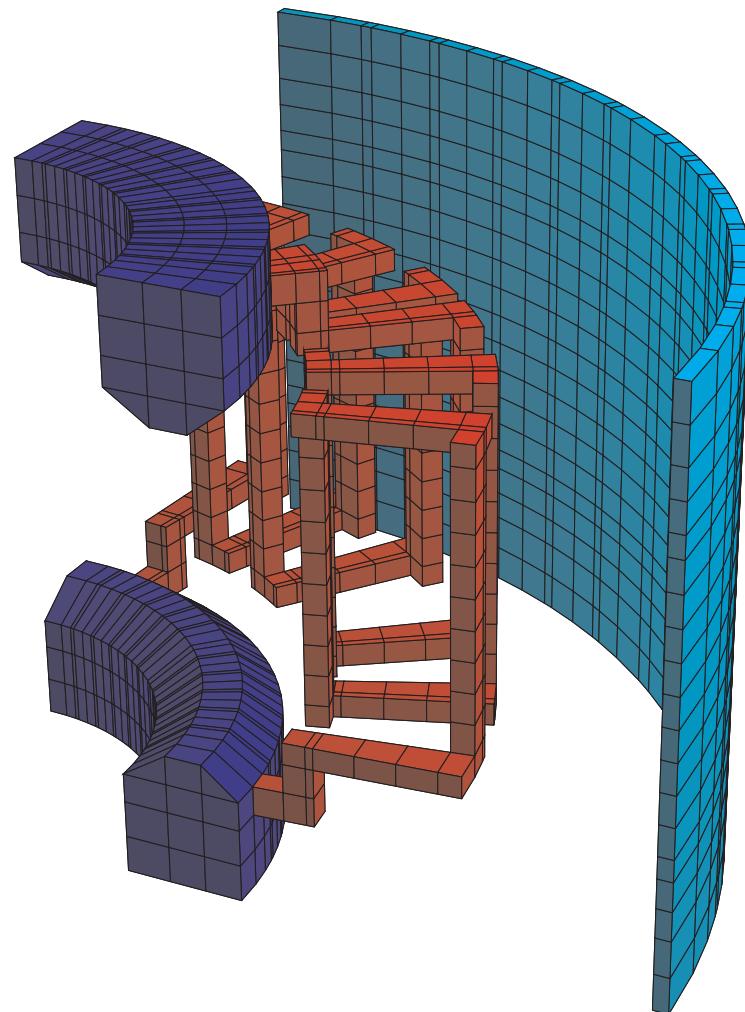
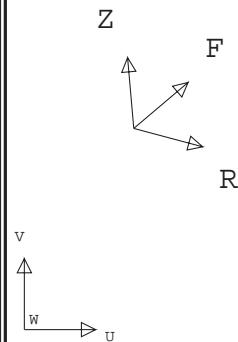
3D PLOT OF THE MATERIAL DISTRIBUTION IN THE MESH

M--:3.23

#VOLUME

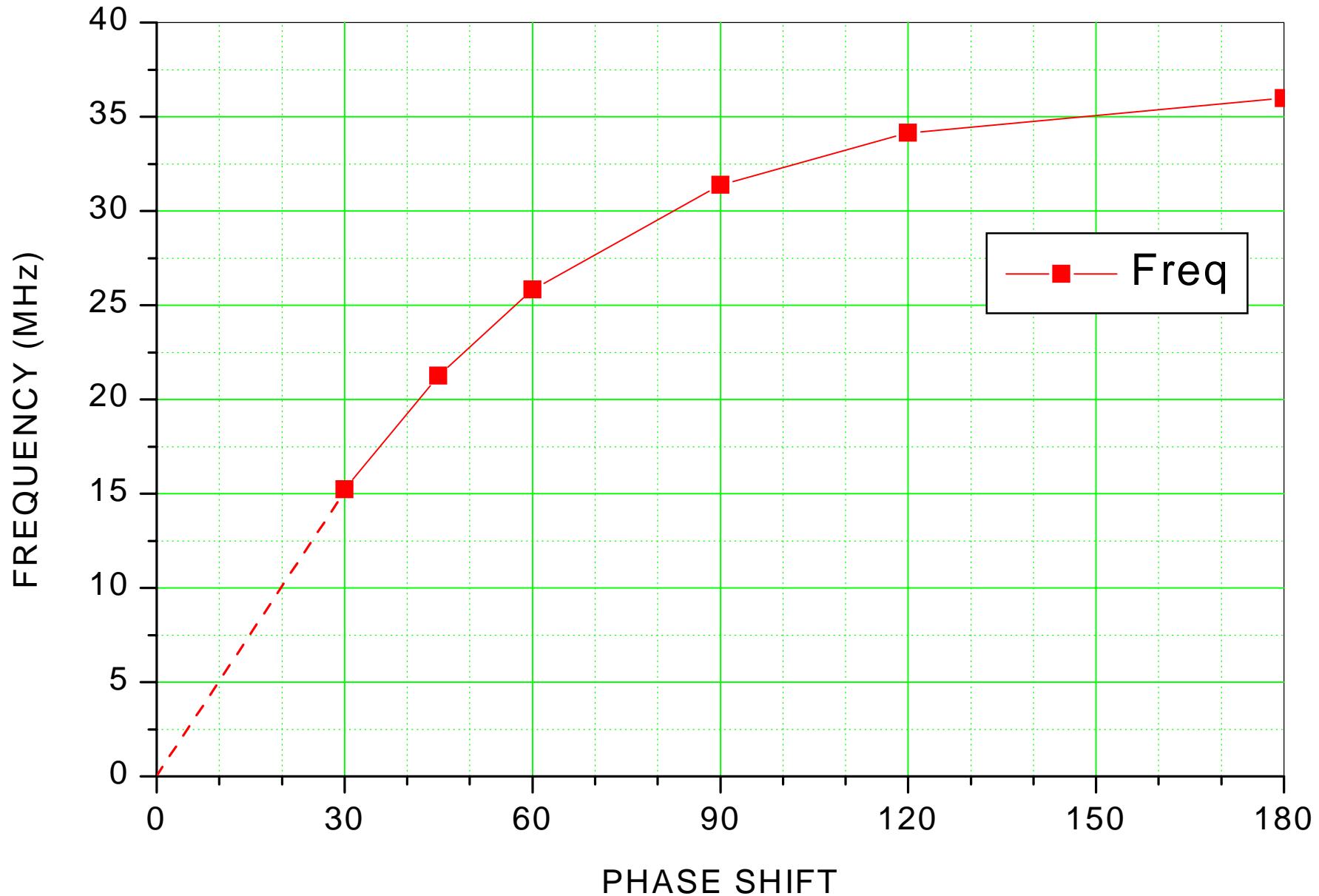
COORDINATES/M  
FULL RANGE / WINDOW  
R[ 0.0000, 1.0200]  
[ 0.0000, 1.0200]  
F[ 0.0000, 90.000]  
[ 0.0000, 90.000]  
Z[ -0.40000, 0.40000]  
[ -0.40000, 0.40000]

MATERIALS: 1, 2, 3,



Sep. 8,1999  
Y. Zhao

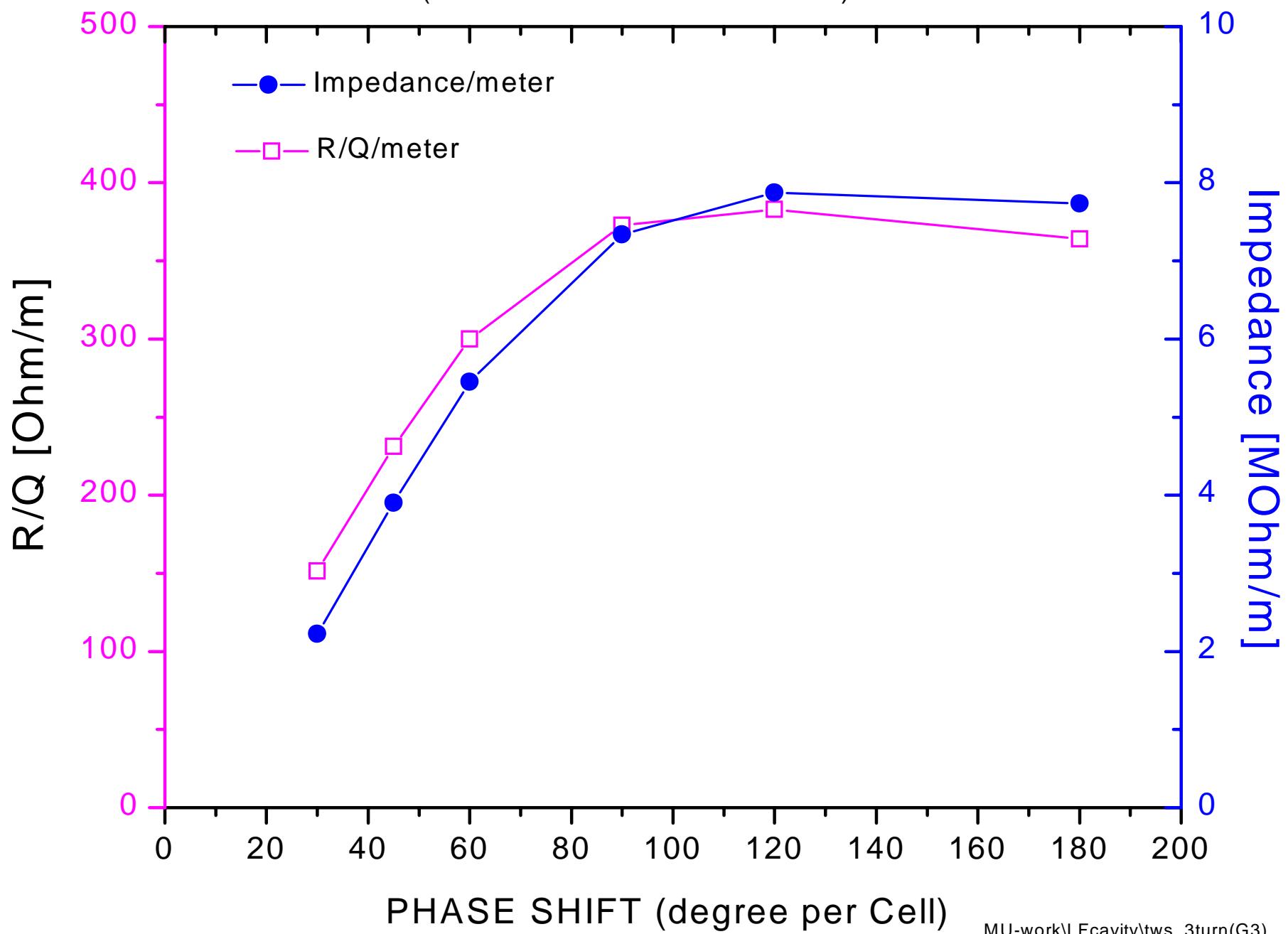
## A LF TRAVELLING WAVE STRUCTURE (3 TURN COIL INDUCTANCE)



Sep. 8,1999

Y. Zhao

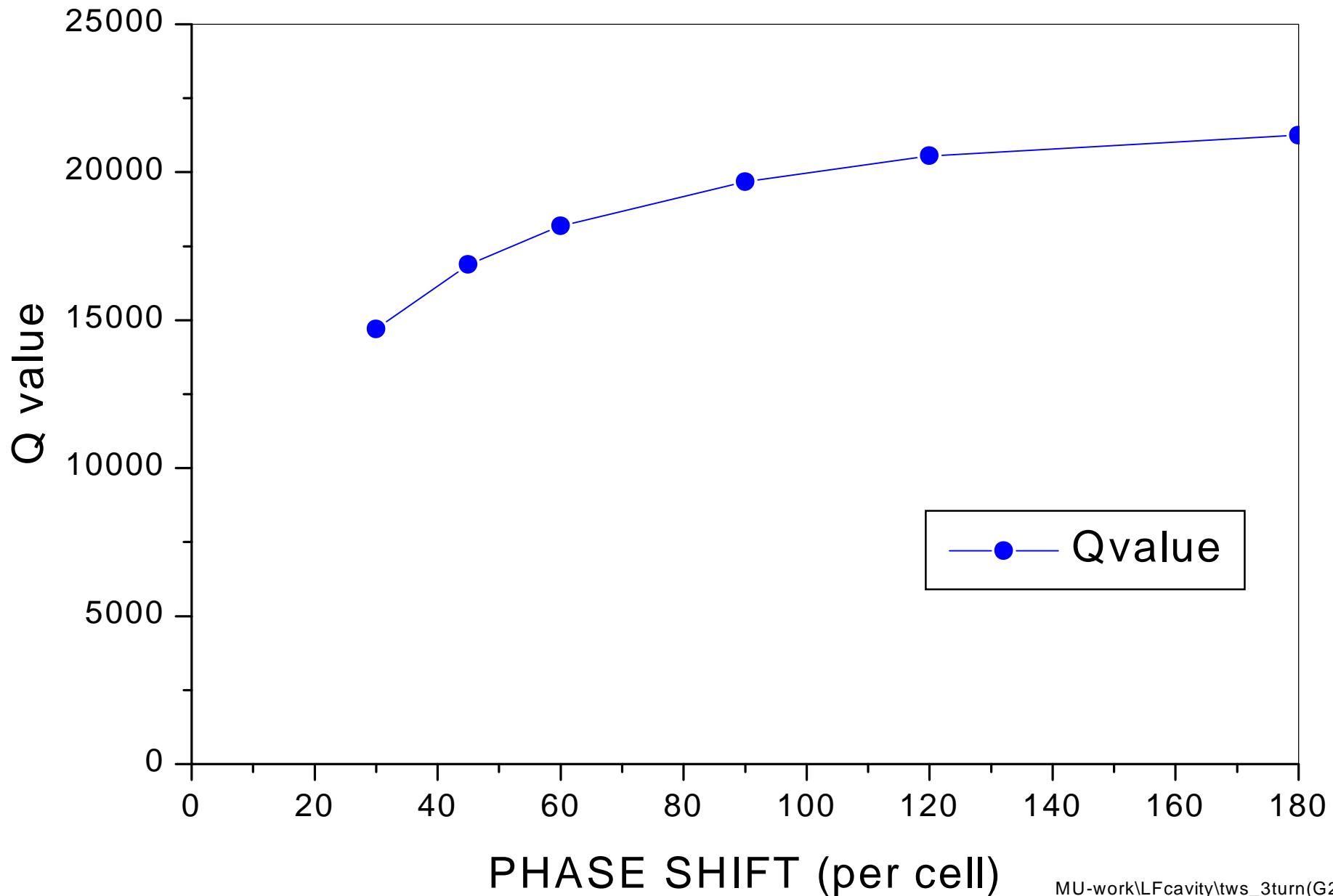
# A LF TRAVELLING WAVE STRUCTURE (3 TURN COIL INDUCTANCE)



Sep. 8,1999

Y. Zhao

# A LF TRAVELLING WAVE STRUCTURE (3 TURN COIL INDUCTANCE)



## The pros and cons

Compact size

30 MHz cavity, Diameter can be 1.2 m ~2.0 m  
( with aperture 0.3m ~ 0.6 m)

Economic

No large parts machined

Low capacitance

Lower storage energy needed

Low Q value

Higher peak power required

Average power may be less due to lower capacitance

Less sensitivity for tuning

(Simulations show not too bad,  $Q > 10,000$  )

Local flux causes residual voltage

All the electrical field, except accelerate field, is transverse, which may be less harmful because of magnetic insulation.

Difficult for simulation

(So far, all simulation of coil structure gave not good solution)

Spring structure may cause poor instability

Careful mechanical design required

LF insulation material applicable

Lower Q alleviate the problem